

CLAIMS:

1. A three-way two-position poppet valve comprising a housing with a first port, a second port, a third working port and a generally cylindrical valve chamber with an axis, said valve chamber being defined between a first coaxial annular 5 valve seat associated with said first port, and a second coaxial annular valve seat associated with said second port, said working port being connected laterally to said valve chamber, said poppet valve further comprising a poppet body disposed in said valve chamber and adapted for reciprocation between two positions so that in a first position the poppet body seals said first valve seat and fluid 10 communication is provided between said second port and said working port, and in a second position the poppet body seals said second valve seat and fluid communication is provided between said first port and said working port;

wherein

said housing has a first coaxial cylindrical passage adjacent said first valve 15 seat and a second coaxial cylindrical passage adjacent said second valve seat, said poppet body has a first coaxial cylinder part slidingly and sealingly fitting said first passage, and a second coaxial cylinder part slidingly and sealingly fitting said second passage, so that said poppet body is always supported in at least one of the cylindrical passages and fluid communication between said first and said second 20 ports is always prevented.

2. The three-way poppet valve of Claim 1, wherein the two coaxial cylindrical passages and the two coaxial cylinder parts of the poppet body have the same diameter D.

3. The three-way poppet valve of Claim 2, wherein said second valve seat is 25 at a proximal end of said second cylindrical passage, adjacent said valve chamber, and a proximal end of said second cylinder part of the poppet is equipped with a second sealing rim matching said second valve seat.

4. The three-way poppet valve of Claim 3, wherein said poppet body further comprises a profiled part adjacent to the distal end of said second cylinder part, so

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that said profiled part would smoothly change the flow through the second port and the pressure in the valve chamber when entering or exiting said second cylinder passage.

5. The three-way poppet valve of Claim 4, wherein said profiled part comprises a shallow straight cylinder step adjacent to the distal end of said second cylinder part, said cylinder step having radial depth and axial length such that, after said second cylinder part leaves said second cylinder passage, pressures in said second port and in said working port are equalized in a predetermined finite time for a given velocity of the poppet body axial movement.
- 10 6. The three-way poppet valve of Claim 4, wherein said profiled part has a shape adapted to change flow section area of the second valve seat as a predetermined function of time for a given velocity of the poppet body axial movement.
- 15 7. The three-way poppet valve of Claim 3, wherein said first valve seat is at a distal end of said first cylindrical passage, adjacent said first port, and a distal end of said first cylinder part of the poppet is equipped with a first sealing rim matching said first valve seat.
- 20 8. The three-way poppet valve of Claim 7, wherein said first cylindrical passage has a proximal part flaring towards said poppet body so that said first cylinder part of the poppet body would smoothly change the flow through the first port and the pressure in the valve chamber when entering or exiting said first cylinder passage.
- 25 9. The three-way poppet valve of Claim 8, wherein said second port is disposed laterally to said axis and said housing further comprises an auxiliary coaxial cylinder chamber of diameter D communicating at a proximal end thereof with said second port and said second cylindrical passage, and closed at a distal end thereof by a lid, an auxiliary piston being mounted for sliding in said auxiliary chamber and being firmly connected to said poppet body by an axial rod, so that the auxiliary piston, the axial rod and the poppet body form a poppet assembly which is
- 30 axially balanced with respect to flow pressure in the second port.

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10. The three-way poppet valve of Claim 9, wherein said auxiliary piston sealingly fits said auxiliary cylinder chamber, thereby defining a sealed volume between said lid and said auxiliary piston, said sealed volume being provided with fluid communication to said first port, so that pressures acting on the poppet assembly from said sealed volume and from said first port are equalized.
11. The three-way poppet valve of Claim 10, wherein said axial rod extends, with a sealing sliding fit, through an opening in said lid and is connectable to an external drive means for moving the poppet assembly between the two positions thereof.
- 10 12. The three-way poppet valve of Claim 11, wherein said drive means is a hydraulic cylinder connected to said rod.
13. The three-way poppet valve of Claim 10, wherein said fluid communication is provided by an external pipe connecting said sealed volume to said first port.
- 15 14. The three-way poppet valve of Claim 10, wherein said fluid communication is provided by a channel obtained through said axial rod.
15. A work exchanger module adapted to utilize the energy of high-pressure working fluid for pumping feed fluid to a feed fluid consumer, comprising an exchanger cylinder with a first working fluid end and a second feed fluid end, a piston freely sliding therebetween, and a first three-way poppet valve according to Claim 10, said poppet valve being connected by its working port to said first end, by its second port to a source of high-pressure working fluid and by its first port to a non-pressurized discharge outlet.
- 25 16. The work exchanger module of Claim 15, further comprising a second three-way poppet valve according to Claim 10, said second poppet valve being connected by its working port to said second end, by its first port to a source of low-pressure feed fluid and by its second port to a high-pressure feed fluid consumer.
17. The work exchanger module of Claim 16, wherein the axial rods of the two
30 poppet valves are extending outside the housings, the module further comprising a

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first hydraulic cylinder connected to the rod of the first poppet valve for driving thereof and a second hydraulic cylinder connected to the rod of the second poppet valve for driving thereof.

18. The work exchanger module of Claim 17, where said hydraulic cylinders
5 have each a "push" and a "pull" port, such that connecting the "push" port to a pressure source would drive the associated poppet valve to the first position thereof and connecting the "pull" port to a pressure source would drive the associated poppet valve to the second position thereof, wherein the "push" port of the first hydraulic cylinder is connected directly to the "pull" port of the second hydraulic
10 cylinder.

19. The work exchanger module of Claim 18, wherein the flaring part of the first cylindrical passage in said first three-way poppet valve is axially longer than the corresponding flaring part in said second three-way poppet valve, so that during synchronized motion of the two poppet bodies towards opening the first port in
15 both three-way valves, the first port in the first valve is connected to the exchanger cylinder before the first port of the second valve.